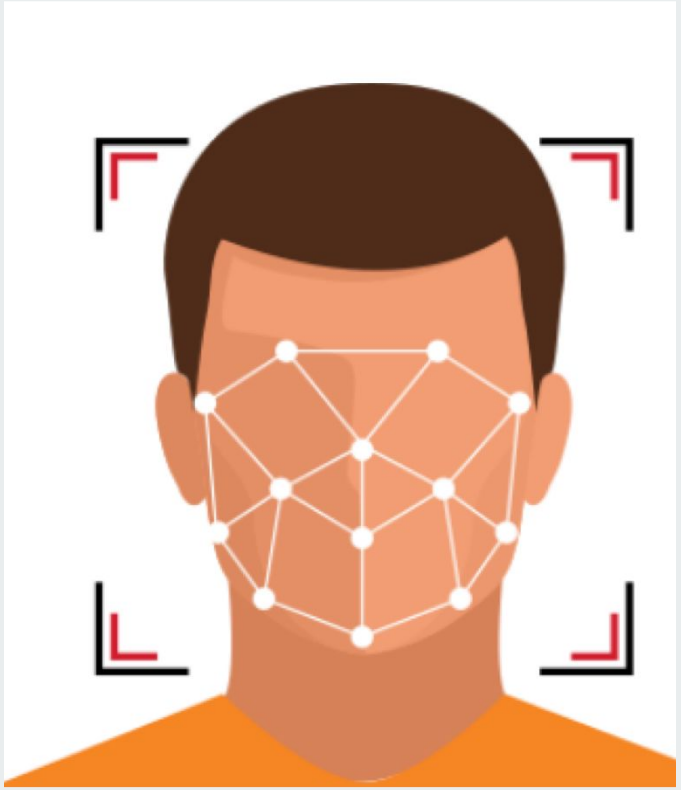
FACE TRACING

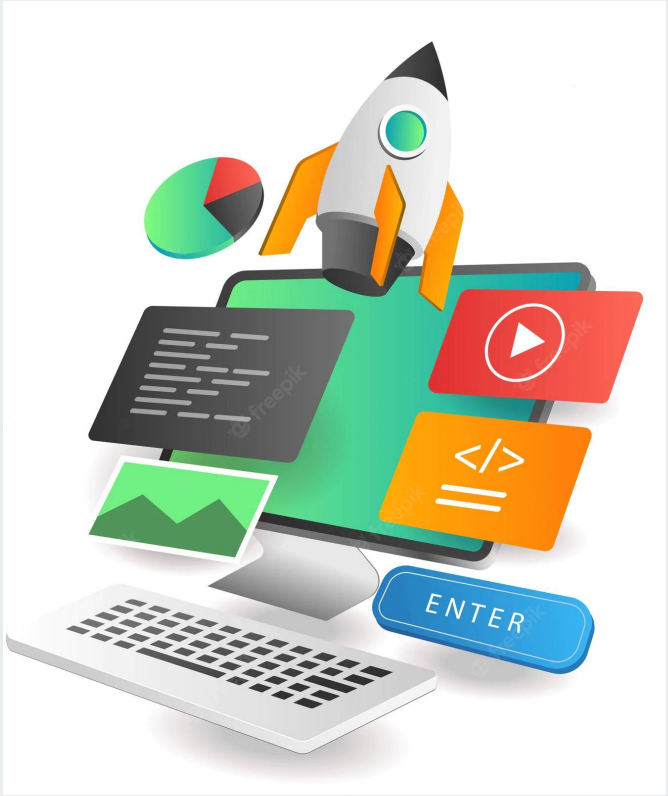
17-691 Machine Learning in Practice

Group 6:
Chunying Li, Daniel Huang, Xiaoting Wang

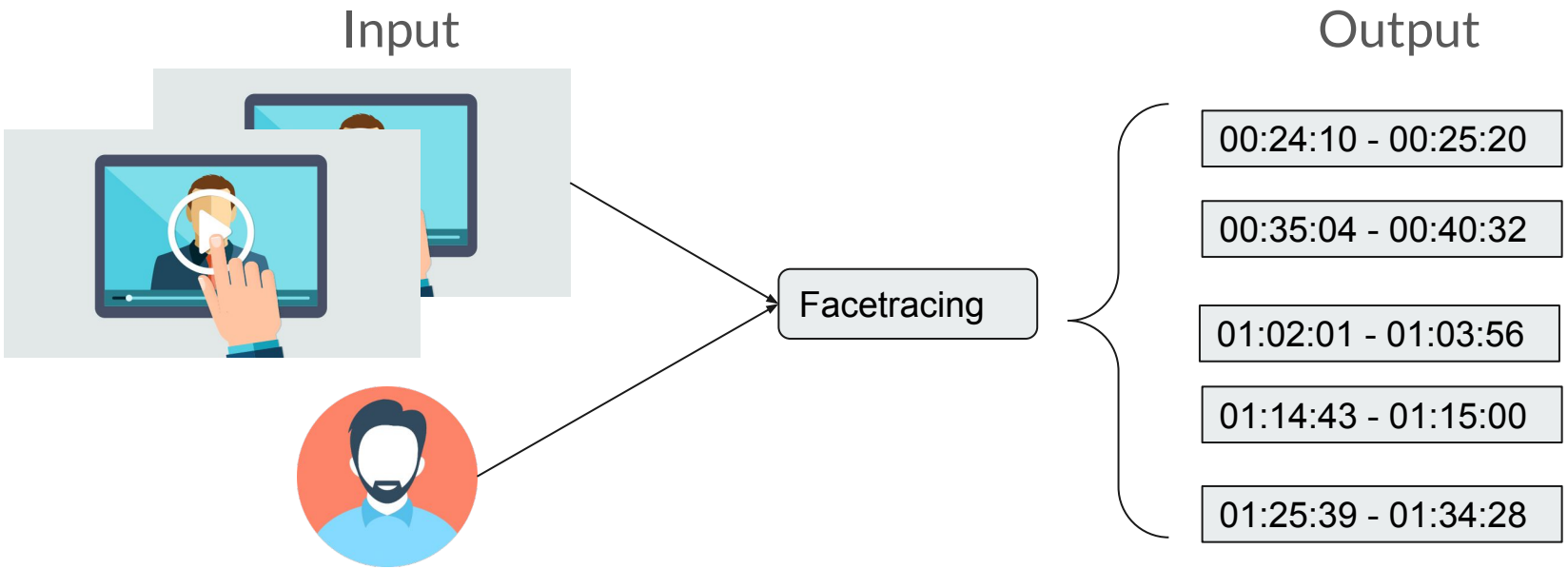


1 - Product

Product Overview
AI Canvas
Product Team
Value Proposition
Business Model



Product Overview



AI Canvas

Opportunity
AI market is booming, Adoption for Image Recognition, Computer vision algo availability

Solution
An app using Image Recognition tech to locate target person in a video

Users
Youtubers who need to do a lot of video clipping. Law enforcement

Data
Videos and one target person picture

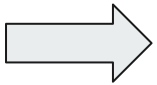
Strategy
Our product is the only product in the market provides such services. We will continue modifying our product based on demand in certain scenario

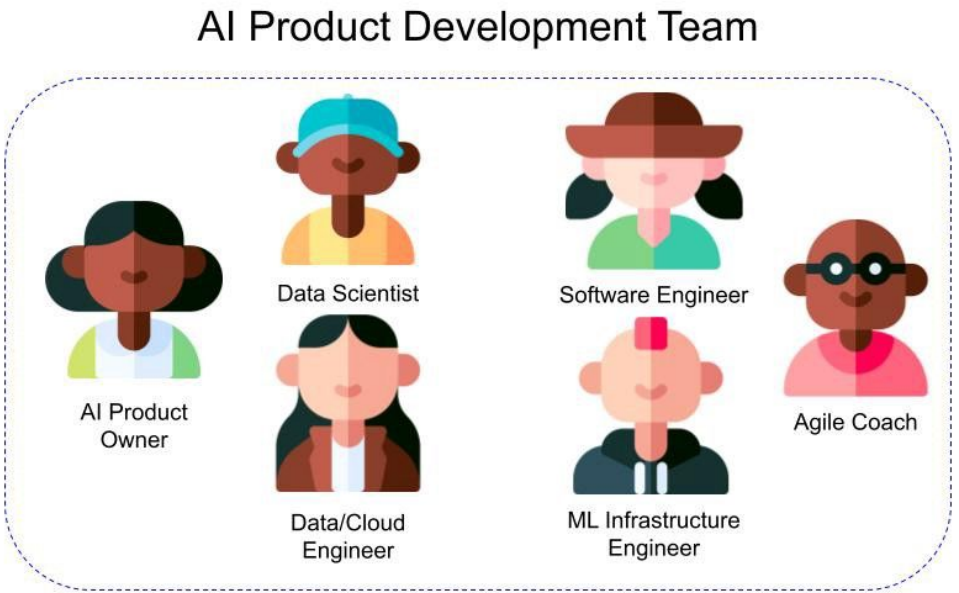
Product Team

Xiaoting
Software Engineer

Chunying
MLOps / DevOps Engineer

Daniel
Data Scientist





Value for Users

30-60 minutes editing ⇨ 1-minute finished video

24-hour surveillance video ⇨ Time frames of target suspects

Facetracing could help find the target person within seconds instead of hours of human work

Business Model

Subscription

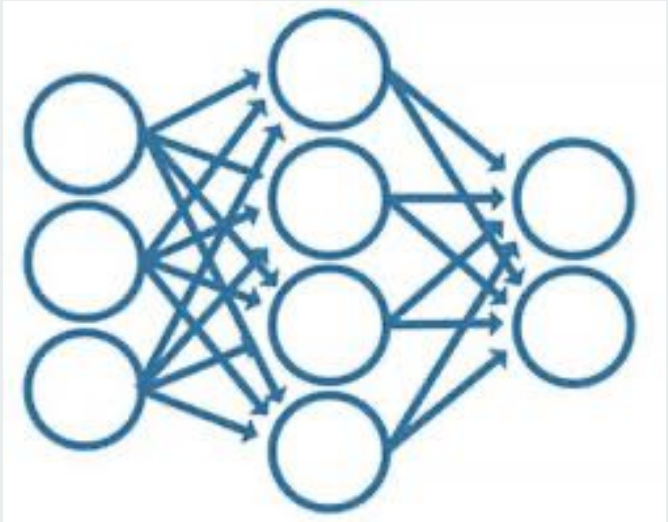
Weekly	Monthly	Yearly
$ 4.99 Week	$ 9.99 Month	$ 59.99 Year

One-Time Use

Video Length	One-Time Charge
<30 min	$0.01/min
30 min - 120 min	$0.02/min
>120 min	$0.03/min

2 - Model

Model Iteration
Model Tuning and Metrics
Data Flywheel / Network Effect
Ethics and Governance

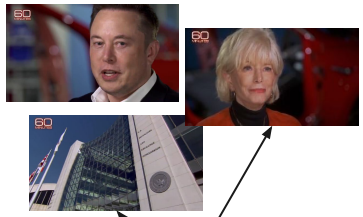


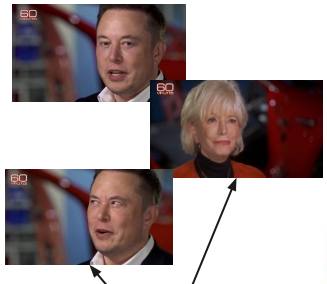
Model Iteration and Development

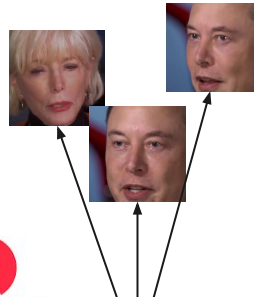
Compare Each Frame with Uploaded Photo → Only Compare Frames with Faces → Compare Face with Faces → Self Reinforced Learning

Video 1m46s

Photo







OpenCV

...

Cohen's Kappa

Kappa : 0.03
Time: 2m13s

Kappa : 0.05
Time: 1m20s

Kappa : 0.18
Time: 22s

Kappa : 0.34
Time: 29s

Model Tuning and Metrics

01	**Precision : Any wrong person?** **Final: 1.0**	• Very problematic for editing • Priority at this stage • Improve by Increasing threshold
02	**Recall : Can we capture all frames?** **Final: 0.52**	• Less concerning at this stage • Trade off with precision • Required for future stages (Law Enforcement)
03	**Time : How long does it take?** **Final: 26.37s**	• Vary by computer • Should not be longer than video itself • Future deployment on Cloud

```
Test Paprameter:  0.000000
Accuracy: 0.613208
Precision: 0.706
Recall: 0.155556
F1 score: 0.2545
Kappa: 0.118458
Wall time: 26.37
```

```
Test Paprameter:
Accuracy: 0.5188
Precision: 0.434
Recall: 0.444444
F1 score: 0.4395
Kappa: 0.018162
Wall time: 26.370000 s
```

```
Test Paprameter:  2.000000
Accuracy: 0.622642
Precision: 0.586207
Recall: 0.377778
F1 score: 0.459459
Kappa: 0.189912
Wall time: 26.370000 s
```

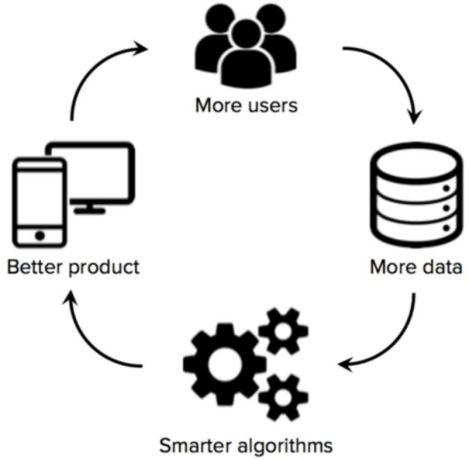
Best Parameters:

1. Pretrained Algorithms
Facenet
Facenet512
OpenFace
...

2. Distance Metrics
Cosine Similarity
Euclidean
Euclidean L2

3. Distance Thresholds
For match <= **0.4**
For update <= match * **0.6**

Data Flywheel / Data Network Effects



Online Cloud Deployment

Establish pre-trained database for celebrities

Store user uploaded image & frames (anonymously, with consent)

Real-time update

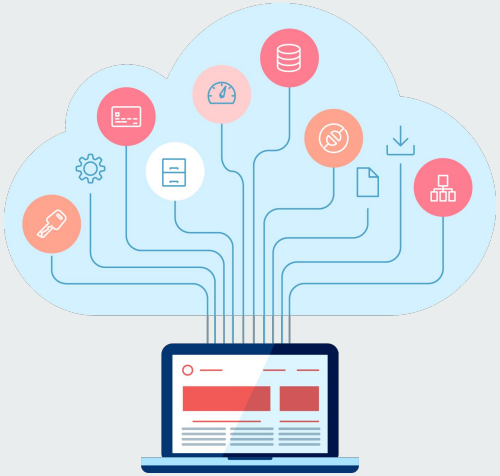
Ethics & Governance

1. Should we use user uploaded medias?
2. Are click-wrap agreements ethical?
3. How to ensure data security and privacy
4. Will future law enforcement uses lead to bias?
5. Will there be Copyright concerns?

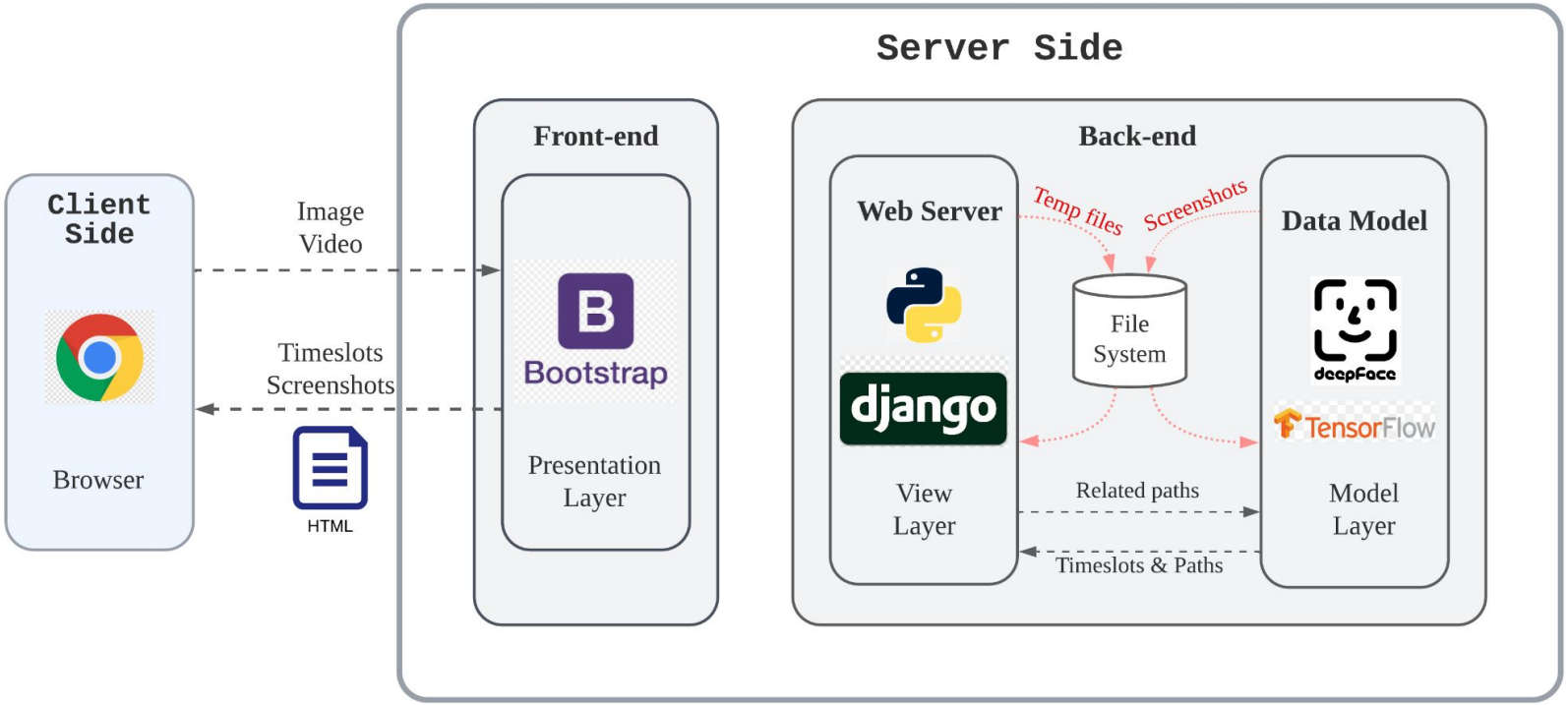
3 - Architecture

Current Architecture
Lesson Learned:

- Concern 1: Deployment & Scaling
- Concern 2: Data Pipeline
- Concern 3: Monitoring

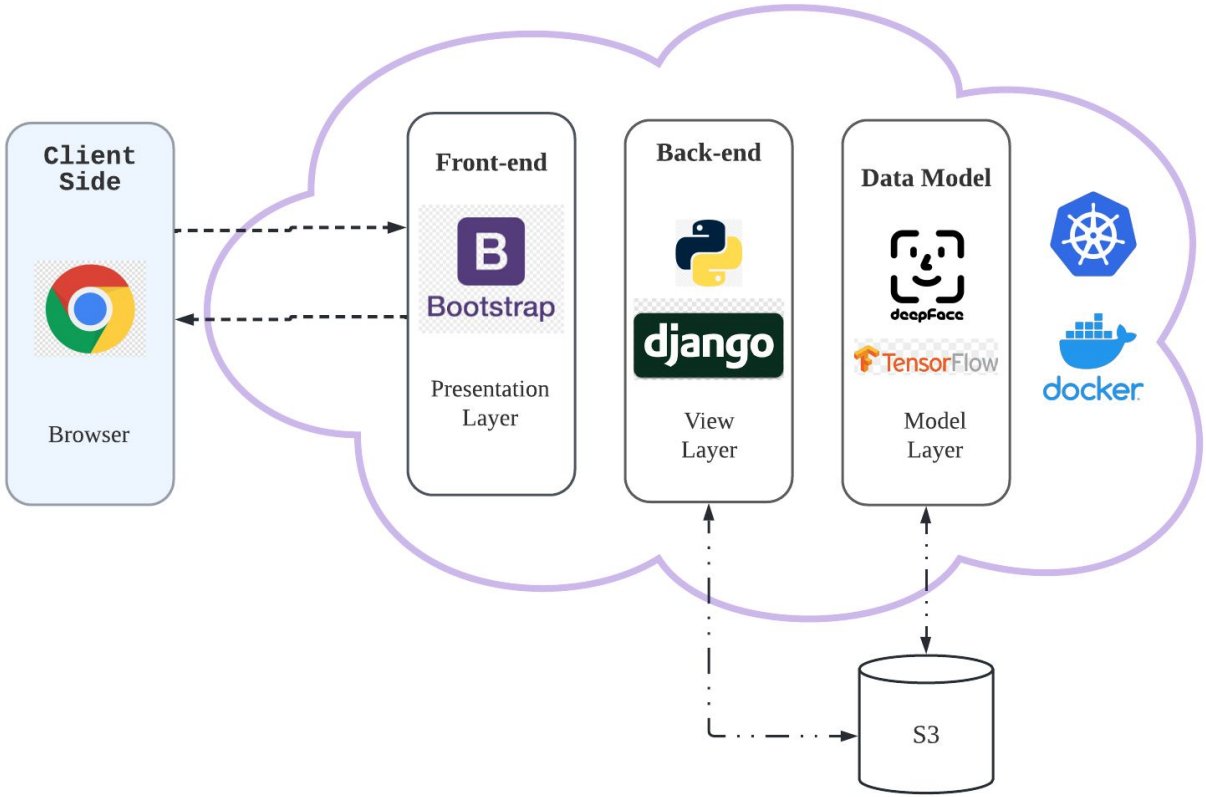


Architecture - Current



Architecture - Concern 1: Deployment & Scaling

1. Create **CICD** pipeline
2. Deploy to the **Cloud** and orchestrate using Kubernetes & Docker
3. **Network & performance**: VPC, Load Balancer, Scaling
4. Leverage **data warehouse** to replace local File System
5. Model is packed and deployed with the application



Architecture - Concern 2: Data Pipeline

Data pipelines built in Data engineering container:

data collection

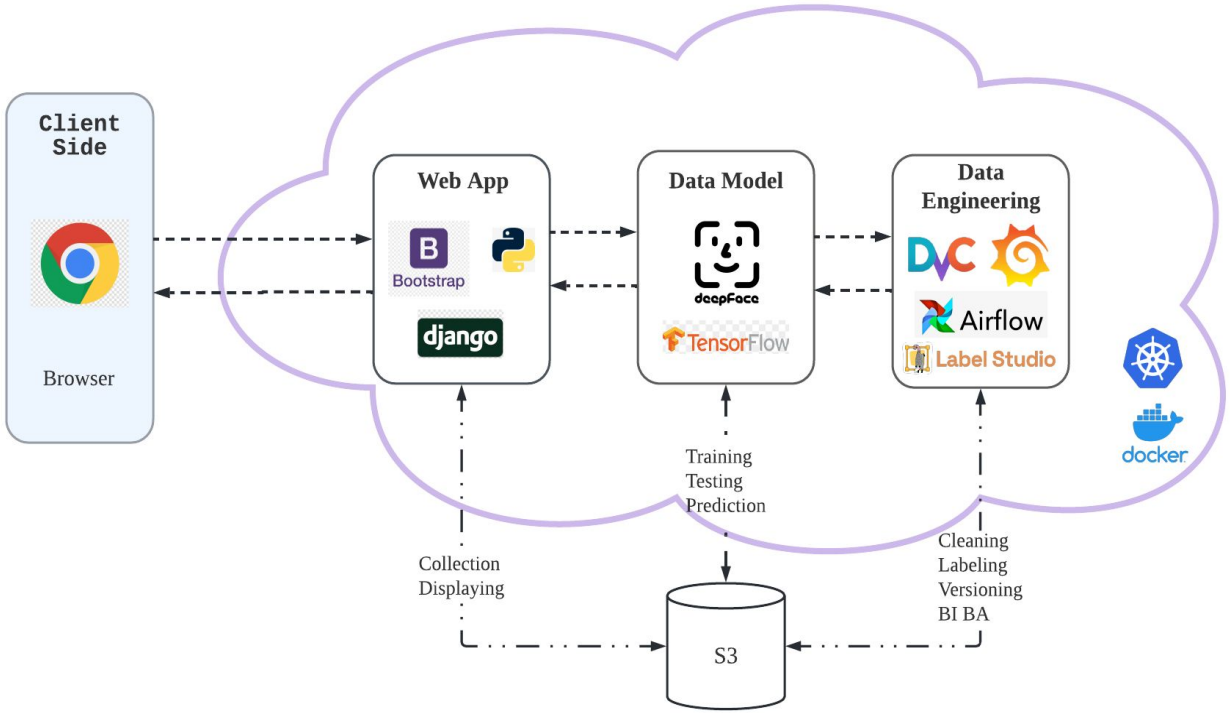
→ data cleaning

→ data storage (DVC)

→ data labeling (Label Studio)

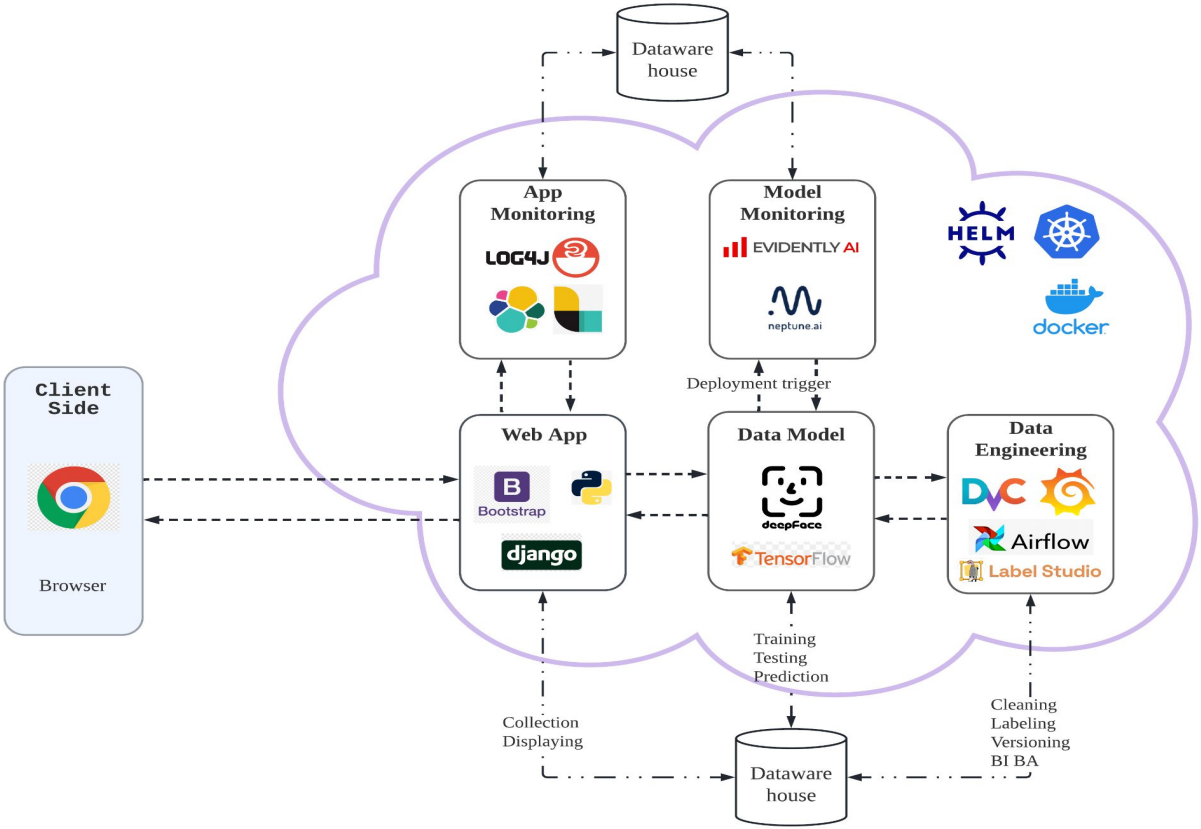
→ data analysis (SQL)

→ visualization (Grafana)



Architecture - Concern 3: Monitoring

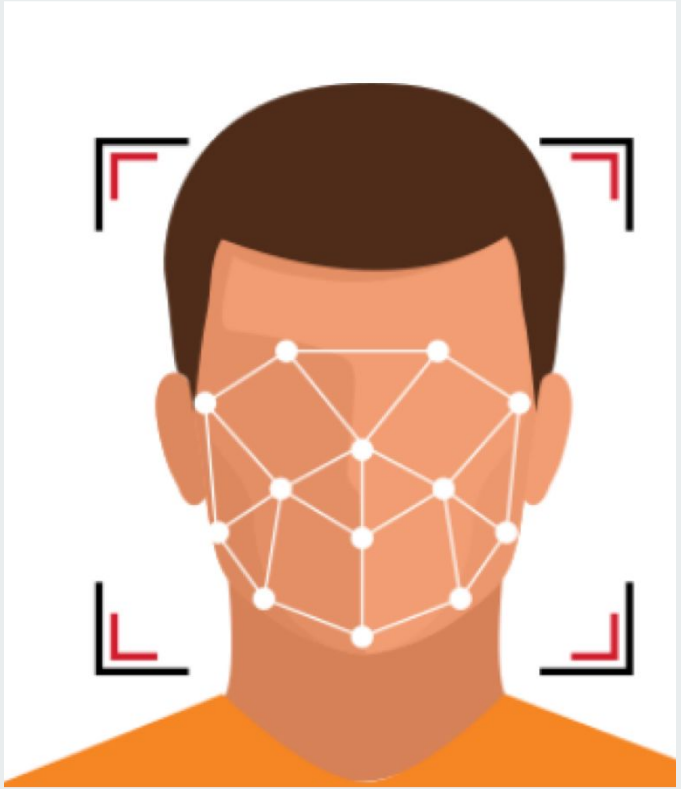
1. **Model Metrics:** accuracy, precision, recall
2. **App Metrics:** system performance, errors, crashes
3. **Model Monitoring**: Evidently.ai, Neptune.ai, logs
4. **App Monitoring**: Kibana, Logstash, Prometheus…
5. Logs are integrated into separated databases
6. Keep improving!



Demo

URL:
https://github.com/makethedayunique/cmu-17691-facetracing-app

Youtube:
https://youtu.be/7nkgZSSvjhc



Any Question?

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